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CENTRAL NATIONAL HERBARIUM (CAL)—PAST, PRESENT AND PERSPECTIVES FOR THE FUTURE

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"A herbarium", as Lawrence defines it, "is a collection of plant specimens that usually have been dried and pressed, are arranged in the sequence of an accepted classification [can be purely alphabetical], and are available for reference or other scientific study" (Shetler 1969). Cronquist (1966) added that "a herbarium can be a very useful teaching aid or an absorbing hobby......" Burkill (1965) states, "Into the Kingdom of Scientific Botany, the main route is that of taxonomy; the landmarks are genera and species, the places of rest and refreshment are Botanic Gardens, Museums [including Herbaria], and the learned societies and the like".

Seen in this context, the Central National Herbarium of to-day, being the repository of about a million and a quarter specimens (a very rough estimate) representing not only the Indian but a sizeable sample of the World flora, provides an essential aid to progress of taxonomic research in India, both fundamental and applied. The classificatory sequential arrangements of hundreds of genera and thousands of species, a huge assemblage of the 'types' of many of the Indian taxa and preservation of duplicate set of the famous Wallichian sheets, amongst many other classical collections made during the 19th century, impart to the Central National Herbarium (hereinafter abbreviated as CAL) a prestigious position as a national heritage of India. Indeed, popularly known as the Calcutta Herbarium, the CAL enjoyed a pride of place in taxonomic botanical researches and attracted taxonomists and horticulturists from all the world over during the 2nd half of the 19th century and the first quarter of the 20th century. Botanists working at the time on the flora of South-east Asia and Australia, could not draw meaningful conclusions unless they spent a few weeks within the precincts of the Calcutta Herbarium.

I propose to delve for a while into its chequered past extending over the last one hundred and ninetytwo years. Comprising four phases between 1793 to 1979 the past history of CAL is so inextricably woven with the establishment of the Indian (formerly the East India Company's/Royal) Botanic Garden that it is difficult to avoid reference to the one when dealing with the past history of the other. Ghosh (1948), Mukerjie (1959) and finally, Burkill (l.c.), amongst others, have dealt with the gradual growth and expansion of this national archive of plant specimens, rather exhaustively. I would therefore refer to the contributions made to the establishment of the Calcutta Herbarium by Roxburgh and his next important successor, Nathaniel

Wallich in some detail and thereafter, catalogue certain highlights of its past and then discuss the present strategy for building up the essential infrastructure for research on the flora of India and outline perspectives for the future.

FOUR PHASES OF DEVELOPMENT (1793-1979)

Phase I : From William Roxburgh (Nov. 1793) to Nathaniel Wallich (1831)

It was at the suggestion of Robert Kyd, the then Secretary in Calcutta to the Military Department of Inspection of the erstwhile East India Company that an area of 310 acres on the western bank of the river Hooghly ± 8 km below Calcutta, was approved in 1787 by the Govt. of the E.I.C., to constitute a Botanic Garden and Kyd was put in charge of this garden in addition to his own duties.

Consequent to the death of Kyd in 1793, Dr. William Roxburgh, a Scottish Surgeon of the E.I.C. at Samalcottah (off Madras) and a botanist of repute, was appointed in November 1793, as the first official Superintendent of the Calcutta Botanic Garden. It was after Roxburgh's appointment that plants of botanical interest were introduced increasingly for cultivation along with the ornamental and economic plants in the garden. Who is then the founder of the Calcutta Botanic Garden? Burkill (1965) considers Kyd as its founder for Horticulture and Roxburgh in great measure, for Botany. The History of the CAL is considered to have emanated from appointment of Roxburgh in 1793.

William Roxburgh 1793 to 1813

On his advice, a 3-storeyed building was built on the bank of the river Hooghly in the South-western corner of the garden in 1795 for Roxburgh's stay and work. Strongly built and known to-date as *Roxburgh House*, the first storey has been used as the official residence of Roxburgh and his successors; the 2nd storey for housing the Calcutta herbarium and the library from 1842 to 1883 and the ground floor used variously : for the herbarium (from 1795 to 1842) and for office and/or as a storehouse thereafter.

Roxburgh received live seeds/plants from some 60 donors/friends of the Garden, including his two sons : William Roxburgh (Jr.) and John Roxburgh. He maintained a *Plants-inward record* for every species received and planted these species in the Garden according to the artificial Linnean (1738) Sexual System of classification. He dried specimens cut from plants when these flowered in the Garden and preserved them as herbarium specimens. He employed several local artists to draw, both in colour and in black and white, as many as 2583 species, each in duplicate. These Iconographs constitute the *Icones Roxburghianum* : the original set bound in 35 volumes is housed in the library of the Botanical Survey of India, Howrah and the other set (unbound) preserved in the library of the Royal Botanic Gardens, Kew, U.K. (see Sealy 1956-1957). The Botanical Survey of India is publishing plates of this *Icones* in fascicles. They illustrate the 'types' of several new species Roxburgh listed in *Hortus Bengalensis* (1814) and subsequently described in his *Flora Indica,* the latter published after Roxburgh's death in 1815, by his friend William Carey : the 1st edition—Vol. 1 (1820) and Vol. 2 (1824) (with additional notes appended by Nathaniel Wallich), were followed by the 2nd edition in 3 volumes (1832), Carey utilising the original manuscripts left with him by Roxburgh and deleting the additional notes Wallich had included in vol. 2 (1824). [The cryptogamic portion of the Roxburgh's manuscripts was published by William Griffith in 1844.] These volumes are the first compendium dealing with ca. 3500 species of Indian angiosperms in the Linnean system of binomial nomenclature and are a fitting tribute to the genius and botanical acumen of the father of Indian botany, Dr. Roxburgh. Unfortunately, he did not bequeath to CAL a herbarium of dried plants which he described and illustrated; he sent them away to Europe and his specimens are widely scattered in European herbaria but mainly at BM, K, K-WALL, LIV, MANCH, and BRUX, a few specimens having had way to Smith's herbarium in the Linnean Society's building (LINN) in London.

To-date, only about 30 specimens of Roxburgh have been located in the CAL and it is a matter of regret that we have to search for Roxburgh's types/specimens of Indian origin in European herbaria. Can we then date back the foundation of CAL to 1793 i.e. to the year of appointment of Roxburgh as the first Superintendent? Yes, in a way, when (i) we regard some of the 'Icones' as the Iconotype of species described by Roxburgh, (ii) the remaining 'Icones' serve as valuable reference for identification, by comparison of specimens being collected to-day (iii) CAL possesses many duplicates of Roxburgh's plants listed by Nathaniel Wallich in his lithographed *Numerical List* (1828-1849, see below).

Nathaniel Wallich (1817 to 1828; 1832 to 1842; 1844 to 1846) (a Danish Surgeon at Seerampore in the service of E.I.C.)

First spell : from 1817 to 1828 : Roxburgh took ill and left Calcutta in summer of 1813 and James Henry Colebrook (1765-1837) took charge of the Garden.* Francis Buchanan replaced Colebrook for a short period in 1814 but soon retired due to illness after sending away all his remaining collections and illustrations to Europe. On Buchanan's departure, James Hare, Thomas Casey, and finally, Nathaniel Wallich took over as Superintendents for varying periods, but finally, Wallich joined as the Superintendent in 1817 and continued until his departure on leave for U.K. in 1828. Wallich made and received from his collectors enormous collections of plants from Nepal, Kumaon, Gilgit and Deccan in India, Ava, Irrawady delta, Mandalay, Myomyo in Burma, Penang, Perak, Singapore and other places in Malaya peninsula.

Following the examples of Roxburgh and Francis Buchanan, (changed to Francis Hamilton after 1820 and the surname adopted for botanical purposes as Buchanan-Hamilton and abbreviated as Buch.-Ham.), Wallich got illustrations of 552 species drawn by local artists. He sent away the first lot of specimens (received by him from his collector, Kamroop) to John Smith in London on 24.5.1819. On his proceeding on sick leave in 1828, he took, away to London all his priceless collections, nearly 7683 species and a huge number of duplicates together with many of the specimens of Roxburgh, Buchanan-Hamilton and of other collectors' gathered in the *'Seed-Shed'* or basement of *Roxburgh House* upto his time (See Burkill 1965 : 37); only a few specimens kept in the Seed-Shed or in the basement of Roxburgh House were presumed to have been left by him. He entertained no idea of building up a herbarium in India. During his leave in London, Wallich sorted out his own collections under 7683 numbers with many thousands of duplicates, the larger part subdivided again by letters a,b,c,d, etc. and catalogued them. He and Bentham transferred the entries from his manuscript on to the stone for his lithographed 'A Numerical List of Dried Plants in the East India Company's Museum, collected under the Superintendence of Dr. Wallich of the Company's Botanic Garden at Calcutta, London' (1828-1849) (often cited as Wallich's catalogue) (see Stafleu, 1967). This 'Numerical List' lists botanical names of taxa (many of which were *nomina nuda* then) against 9148 members. Wallich's main set thus numbered comprised more than 20,000 specimens and was incorporated in the herbarium of the East India Company which came to LINN in 1832, but finally transferred to Kew (K.) in 1913 and constitutes there a separate wing, K-WALL. Thousands of duplicates of the main Wallichian set were distributed from London after 1826 under the auspices of the East India Company and are located in several major herbaria of the world.

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* A. K. Ghosh (1948 : 222) : When Roxburgh was obliged to leave Calcutta in 1813, Dr. William Carey was put in charge of the Calcutta Botanic Garden by the local government; Carey acted as Superintendent for 6-12 months until Buchanan relieved him in 1814.

It is pertinent to mention here that whereas Wallich attributed 3250 numbers of his *Numerical List* as originating from Nepal, David Don's (1825) *Prodromus Flora Nepalensis* describes 700 species based on Wallich's and Buchanan-Hamilton's collections largely from Nepal with some species collected from outside Nepal.

Phase II (1832-1890) : From Dr. Nathaniel Wallich's return from leave 1832 to Sir George King's appointment in 1890 as ex-officio Director, Botanical Survey of India

During this phase of development, the following held successively the charge of the post of Superintendent of the Calcutta Botanic Garden and set up, organised, developed and maintained the Systematic Botany Wing, better known as the Calcutta Herbarium : (a) *Nathaniel Wallich*—1832 to August 1842 and August 1844 to August 1846; (b) *Friedrich Sigismund Voight* (~Voigt) (August 1842 to December 1842); (c) *William Griffith* (December 1842 to August 1846); (d) *John McClelland* (August 1846 towards the end of 1846); (e) *H. Falconer* (end of 1846 to 1954); (f) *Thomas Thomson* (1854-1861); (g) *Thomas Anderson* (1861-1866); (h) *Charles Baron Clarke* (1866-1872); (i) *George King* (1872-1890).

During the second spell of his Superintendentship from 1832 onwards, Dr. Wallich faced difficulties in the identification of his fresh collections in the absence of a well-identified set of the earlier collections of Roxburgh, Buchanan-Hamilton and of his own at Calcutta. Unsuccessful in obtaining even a set of his own unaccessioned specimens from London, he proceeded vigorously to build up a herbarium in the basement of Roxburgh's house. In this effort he was assisted by plant collectors, both from India and abroad.

Dr. Griffith during his short tenure of about one year nine months as Superintendent is acredited with having re-organised 'a collection of collections' assembled by Wallich to a 'Working Herbarium', to have set up several 'local herbaria' such as for 'ASSAM', North-West Himalayas', Sikkim, Bihar and Orissa etc. etc. and a Library in the more airy top-storey of the Roxburgh House. He received specimens from several plant collectors from far and wide. He arranged return from London of many of the illustrations of Indian plants sent away by Buchanan-Hamilton and Wallich and 'willed' all his herbarium specimens, drawings, spirit-preserved materials and manuscripts to the East India Company. John McClelland, who relieved Dr. Wallich in August 1846 on account of the latter's continued ill-health, sorted out a set of Griffith's collections for incorporation in the Calcutta Herbarium.

Falconer during his tenure of office sent his own collectors to Khasia Hills and received from Kew a set of duplicate Indian specimens collected by Thomas Thomson (1817-1878) and Joseph Dalton Hooker (1817-1911) between 1839 to 1851, either separately or together, (see below).

Thomas Thomson (1854-1861) : From 1839 onwards Thomson had been collecting plants from North-Western India, Kashmir etc. ; he joined J. D. Hooker at Darjeeling in 1848 and they together collected plants from Sikkim, Khasi & Jainta Hills, Sylhet, Chittagong etc. ; they left for U.K. in February 1851 with all their collections—1,50,000 specimens representing nearly 3,500 species from Sikkim, 3,000 species from Khasia Hills, 1,000 species from the plains of north-eastern India and lastly, some 2,000 species from the north-western Himalayas.

On his return to India in 1854, Thomson brought with him duplicates of specimens as much as he could, of his own and of Wallich's and took over charge from Falconer. He incorporated into the "Working Herbarium" the set of Griffith's collections sorted out by McClelland and the collections brought over by him. Later, he received from Kew Herb. duplicates of collections of Falconer, J. D. Hooker, Thomson, Robert Wight, Wallich etc. He received bundles of plants collected by Simons, Barry, McClelland, Fayrer, Oldham, Simpson, Cleghorn, Edgeworth, Masters, Jenkins etc., re-organised and consolidated what he termed as the 'Public Herbarium', housed in 93 cabinets upto the time.

Consequent to the taking over of the administration of Indian territories by the British Crown from the East India Company in 1861, the 'Company Garden' or 'Calcutta Botanic Garden' was re-named 'Royal Botanic Garden', Sibpore. Two posts of Curators were created to assist the Superintendent to look after (i) the living plants in the Garden and (ii) the dried plants in the Herbarium and *Sulphiz Kurz* (1833-1878) joined Anderson in 1862 as the first Curator of the Herbarium. He undertook two tours in the Andamans and the Nicobar Islands in 1866 and again in 1872 and one tour in Burma and added many interesting collections. Later, he joined the Burma Forest Service.

A futher large consignment of duplicates of Joseph Dalton Hooker's Indian plants were received from Kew in 1867 for incorporation to the Calcutta Herbarium.

C. B. Clarke (1832-1906), during his tenure as Superintendent, added collections from Khasia Hills, Sikkim, Nilgiris, Kangra, Chamba, Kashmir & Karakorum etc. He took considerable part of his collections to Britain and worked them out at Kew from 1877 to 1883. (He returned to Assam Education Service in 1883 and finally left India for U.K. in 1887.)

George King (1840-1909) as Superintendent : G. King took over charge of the Superintendentship from Clarke in 1872. He appointed John Scott, J. B. Bracer, and later, David Prain successively as Curators but failed to get a Cryptogamic Botanist appointed to the Herbarium. King enormously increased collections for the Herbarium from regions mainly east of Calcutta through his own collections and also by his own paid collectors.

A damp proof and ± fire proof building of masnory and iron except for the doors and windows, was built after the pattern of the Kew Herbarium and King shifted the herbarium and the library from Roxburgh House to this new building in 1883. Many of the staff quarters we see to-day in the Indian Botanic Garden were built during his stewardship.

Phase III (1890-1957)

The third phase may be said to have

emanated from the appointment of Sir George King, Superintendent of the Royal Botanic Garden as the ex-officio Director of the Botanical Survey of India in 1890 and to have ended with the transfer of the Calcutta Herbarium from the administrative control of the Government of West Bengal to the reorganised Botanical Survey of India (hereafter abbreviated as BSI) on 1 April, 1957. This phase may, however, be considered to comprise two sub-phases as follows :

(1) *From 1890 to 1937*—During this period, the following functioned successively both as Superintendent, Indian Botanic Garden, Howrah and as ex-officio Director, Botanical Survey of India :

(i) George King (1890-1897) with David Prain as the Curator of the Herbarium

(ii) David Prain (1897-1906) with Andrews Thomas Gage as Curator.

(iii) A. T. Gage (1906-1923, (1925) with William Wright Smith as Curator (Smith officiated in 1908 in the place of Gage when the latter was on leave), who was succeeded by Calder in 1912.

(iv) Charles Cuming Calder (1923-1939) with P. M. Debbaraman (1923-24), V. Narayanswami (1924-1927) and Kalipada Biswas (1927-1937) functioning successively as Curators (Biswas officiated once in 1931 and again in 1935 in place of Calder when he was away on leave and again from 1937 to November 1939 during the leave preparatory to retirement of Calder).

With the retirement of Calder in November 1939, the post of Director, BSI was abolished. From 1939 till 1955 the Botanical Survey of India was represented by one post of Systematic Assistant only.

(2) *From November 1939—31 March 1957*

During this period, the following Superintendents of the Royal (Indian, after independence of the country in August 1947) Botanic Garden, aided by a Curator maintained and developed the Herbarium Wing :

(i) J. M. Cowan (12 July to 21 November 1937); (b) K. P. Biswas (1937-1955); (c) D. Chatterjee (1955—March 1957) with S. K. Mukerjee continuing as Curator from 1937 to 1957.

The notable events in the development of the herbarium during the 3rd phase are summarised hereunder :

(i) Botanical collections were intensified by King and his successors and exchange of specimens with European and American herbaria started vigorously.

(ii) A large number of books and periodicals obtained from Kew enriched the library.

(iii) Two new journals, *Records of the Botanical Survey of India* and *Annals of the Royal Botanic Garden,* Calcutta were started by George King and the volume 1 of the latter was published in different parts between 1887-1888 and of the former between 1893-1902.

(iv) 186 cabinets containing the herbarium specimens were replaced during 1904-1905 by 32 large double-sided cabinets of Burmese teak, made up of four sections and more almirrahs were added to house specimens held in the 'local herbaria'.

(v) Bentham and Hooker's system (1862-1883) in *Genera Plantarum* was adopted by Prain for the herbarium arrangement in respect of the sequential system of families and genera but the species arrangement was followed after J. D. Hooker's *Flora of British India* both in the General Herbarium and Local herbaria'. Index Cards were introduced for the orders (families)/genera/species available in the herbarium. The pteridophytes were, however, arranged after Hooker and Baker's (1865-'68, 1874) *Synopsis Filicum.*

(vi) E. J. Butler was appointed as Cryptogamic Botanist for one year in 1901, after which the post was abolished.

(vii) The Royal Botanic Garden was renamed the Indian Botanic Garden after the independence of the country in 1947.

Phase IV (1957-1979) : Re-organisation of the BSI

The 4th phase of development of the CAL dawned with the re-organisation of the Botanical Survey of India in 1955 during the second five year plan consequent to which four Regional Circles with Headquarters at Poona, Dehra Dun, Shillong and Coimbatore were established as subordinate offices under the Chief Botanist with his Headquarters at Calcutta.

During the 3rd Five Year Plan, one more Regional Circle of the BSI opened at Allahabad to survey Madhya Pradesh, Rajasthan and Eastern Uttar Pradesh and the boundaries of the earlier four Regional Circles had to be re-adjusted. The next Five Year Plan brought into existence two more Regional Circles—one at Jodhpur for the semi-arid and arid zones of India and the other at Port Blair for the Andamans and the Nicobar group of Islands. It was during the last year of the Fifth Five Year Plan that a field station was set up at Itanagar for the Arunachal Pradesh during March, 1977.

Administration and Organisation of CAL : The following Officers held charge of the herbarium from 1957 onwards : S. K. Mukerjee (Apr. 1957-Aug. 1968), M. P. Nayar (Aug. 1968-Dec. 1972), S. K. Jain (Dec. 1972-Dec. 1973), R. S. Rao (Dec. 1973-Mar. 1977), G. Panigrahi (Apr.-Sept. 1976, as Officer-in-Charge of reorganisation), T. A. Rao (May-June 1977), G. Panigrahi (June 1977-July 1978), G. Sen Gupta (July 1978-Aug. 1978) and M. P. Nayar (Aug. 1978—continuing).

Consequent to the re-organisation and expansion of the Deptt. of BSI as a whole, the Central National Herbarium (CAL) also benefited both in staff strength, provision of funds, facilities and acquisition of specimens.

A new L-shaped five-storeyed masonry building with two large halls in each of the four upper floors was built during the period 1965 to 1970 and the herbarium portion was shifted by December, 1970 from its former location in the double-storyed building built in 1883 to occupy five of the 10 halls in this new building. While the new building as a whole provided a total of 9,300 sq. m. (=98,000 sq. ft.) plinth area, the five halls in the 1st, 2nd and part of the 3rd floors occupied by the Herbarium Wing accounts for about 2400 sq. m. (=25,000 sq. ft.) of floor area only. The library of the Indian Botanic Garden taken over by the BSI from the West Bengal Government in 1962, continued in its original fire-proof and damp-proof site. The library of the Headquarters unit of the BSI brought over from Calcutta in January, 1975, occupied the first floor vacated by the Herbarium wing as stated above.

Between 1956 to-date more than 250,000 field numbers of plants were collected by the officers and staff of the BSI from different regions of India and sets of specimens mounted, labelled and identified were incorporated into the respective Regional herbaria viz. ASSAM, BSD, BSA, BSI, MH, PBL, BSJO and CAL. Of these, about 36,000 duplicates received for incorporation and housed in a separate hired building at Shalimar (Shibpur) were transferred to this new building during 1971 and kept in a separate set of steel cupboards with 27 pigeon holes each.

The herbarium cupboards housing these collections (angiosperms, gymnosperms and the vascular cryptogams) are of three different designs/make : 72 wooden almirahs of Burma teak acquired on transfer of the Herbarium on 1st April, 1957, provide a total of 10,850 pigeon holes : 57 almirahs of 27 pigeon holes each add upto 1539 pigeon holes and 194 steel almirahs with two sliding-doors and with 60 pigeon holes each provide another lot of 11,640 pigeon holes. Calculating on an average of 50 specimens preserved per pigeon hole, the grand total of 24,029 pigeon holes of the existing 323 herbarium cabinets may be estimated to contain 1,201,450 specimens in the CNH (CAL); some earlier reports placed this number at higher figures : 4 millions (see Ghosh, 1948), 2-5 millions (see Mukerjie, 1959), whereas Shetler (1969) stated only 1 million. We propose to carry out a more sophisticated statistical analysis of the CNH holdings (see Brenan 1972) in due course once the backlog of all collections available as in 1979, are incorporated into the CNH.

With a view to facilitate studies on the taxonomy and phytogeography of the Indian flora, it was decided in 1976 that the specimens held in several herbaria (viz. General, Local and Recent) and many thousands of collections of the 19th and early 20th centuries stored separately, plus additional lots totalling ca. 80,000 mounted, labelled and identified duplicates of collections sent by Regional Circles of BSI be arranged into *one* herbarium, arranged in a definite taxonomic and geographical/floristic regional sequence. For the sequential arrangements of families, a modified Bentham and Hooker's (1862-1883) systems and which recognises 304 families within the framework of 200 families of angiosperms with sub-numbers such as 1/1 Ranunculaceae, 1/2 Circaeasteraceae, 1/3 Paeoni aceae etc.) was adopted to bring the CAL *at par* with similar systems adopted in the Kew (K) and the British Museum (Natural History), London (BM). For the geographical sequence, the entire world was divided into 12 broad geographic areas with 24 floristic regions :

1. *Indian Region*
   1/1 India, 1/2, Pakistan, 1/3 Nepal, 1/4 Bhutan, 1/5 Bangladesh, 1/6 Burma, 1/7 Sri Lanka.
2. China, Japan, Taiwan, Korea etc.
3. U.S.S.R.
4. South East Asia
   - 4a. Malaya Peninsula
   - 4b. Thailand, Cambodia, Laos and Vietnam
   - 4c. Malay Islands
   - 4d. Philippines
   - 4e. New Guinea
5. Australia & New Zealand
6. Pacific Islands
7. Malagassay & other Islands in the Arabian Sea

8a. North Africa

8b. Rest of Africa

9. Western Asia
10. Europe (excluding USSR)

11a. North America (U.S.A. and Canada)

11b. Central America and West Indies

12. South America

The specimens belonging to any genus within the family and as available in CAL, were arranged in order of the floristic regions, starting with India (1/1) and ending up with South America (12), depending on the availability of the relevant taxon in CAL. Thousands of *genus covers* and *species covers* were replaced by new ones, appropriately labelled and the entire herbarium was given a new look.

Coloured labels (5 × 2.5 cm) with the name of the floristic region and its code number, were printed and pasted on the 'genus covers' for easy detection of the geographical sequence. Specimens belonging to any particular species collected from any part of India of to-day (1/1) were arranged *State-wise* and white labels with the name of the State/Union territories printed in black, were pasted on the respective 'Species Covers'.

While the numbers allotted to the species continued to be after Bentham & Hooker's (1862-1894) *Genera Plantarum*, and to the species, after J. D. Hooker's (1872-1894) *Flora of British India* (Vols. 1-6), for correct generic name and its appropriate author Airy Shaw (1973), and for the family Poaceae (the Gramineae), N. L. Bor (1960) have been adopted. The pteridophytic herbarium maintained hitherto after Hooker's & Baker's (1865-1868, 1874) *Synopsis Filicum*, was re-arranged after Crabbe, Jermy and Mickel (1975) to bring up the fern nomenclature at family/generic levels uptodate. The species described from India after 1896, were filed alphabetically at the end of the genus; the undetermined/unidentified specimens as available were incorporated at the end of the genus or family, as the case may be, for easy accessibility to botanists/monographers for study and annotation. The estimated number of specimens representing the lower Cryptogams preserved in packets/boxes etc. in the CNH are : algae—4000, fungi—3000, lichens—6000, liverworts—1500 and the mosses 10,000, of which about 7000 constitute historical materials from India and abroad. The algae and fungi tentatively identified are arranged alphabetically; the lichens are classified after Zahlbruchner (1926), the liverworts, after Evans (1939) and the mosses, after Brotherus (1924, 1925).

An alphabetical 'index' to the genera in respect of hundreds of families and the floristic regions in which each genus is represented in CAL, has been plotted by the floristic region code numbers, such as 1/1 for India, 1/2 for Pakistan......9 for Western Asia......12 for South America. The 'index' typed out and pasted on mount boards, is filed in the first pigeon-hole at the beginning of the respective family. The genera not available in CAL, are asterisked in the 'index'. It is intended to procure a representative species of each of such genera from one or the other world herbaria on exchange basis, so that the CAL becomes a true repository of all the known genera and families of, at least, the vascular plants of the world.

Wallich Herbarium : More than 11,000 duplicates of Wallichian collections received in the Calcutta Herbarium during the period 1853-1869 (see Chatterjee 1948) classified and arranged in the *General Herbarium*, family-wise/Genera-wise and annotated with blue or red label, 'Wallich Sheet', have now been segregated from the main herbarium and the Type Section to constitute the 'Wallich' herbarium as a separate wing in CAL. These specimens have been arranged family-wise after the sequence in the main herbarium, but the species, alphabtically adopting the original names used in the 'Wallich Catalogue'. It is intended to undertake comparative studies of these 'duplicates' against the micro-fiches of the original set of Wallich sheets procured on purchase and (i) to see which of the sheets held in CAL are/are not the correct duplicates of the original sheet; (ii) to determine how many of the sheets to be thus authenticated can be designated as 'type' of Wallichian names; (iii) which of the duplicates of the original set numbering more than 20,000 are not available in CAL; (iv) to work out the correct nomenclature of the Wallichian names, many of which although *nomen nuda* at the time, were validated subsequently by Wallich himself or by other taxonomists.

Iconotheca : Several thousands of portraits/drawings/dissections of plants/plant parts, a few hundreds of which are in colour, but largely as black and white line drawings and some of them from printed books [such as from Robert Wight's (1831, 1840-53) *Illustrations* or *Icones*] filed earlier in the *General Herbarium*, have been pulled together to constitute the *Iconotheca* to facilitate study and reference. Their taxonomic significance in relation to the studies undertaken in the Flora of India project is immense and they would repay critical evaluation (see also Chatterjee 1948).

National collection of 'Types' of Indian taxa : About 10,000 'Types' and authentic specimens of taxa represented in CAL, and dispersed in the *General Herbarium* and *Local Herbaria* upto 1964, were segregated during the Indo-Pak war of 1965 for reasons of safety and more careful attention and constituted the "Type Specimens Herbarium'.

The process of scrutinising the specimens in this herbarium as also those still remaining unsorted in the re-organised main herbarium. has been initiated. The label data in respect of such specimens are being checked to determine their 'Type' status (viz. Holotype, Isotype, Syntype, Lectotype, Paratype etc.) in relation to the basionym/original name of the taxon concerned. The objective data in respect of such types are being transferred to an *Input Form* with 25 descriptor heads standardised for the purpose. It is intended to print-out a "Botanical Type Specimens Register for India" with the aid of a computer and thereby establish collaboration with an international endeavour designed to print-out an International Botanical Type Specimens Register (see Brenan *et al*, 1975).

To aid taxonomic research, microfiches of 16 European herbaria, such as the Wallich's collections in K-WALL, Willdenow's herbarium in Berlin (B), Linnean herbarium in London (LINN) and in Stockholm (S), A. P. De Candolle's herbarium in Geneva (G-DC), Jussieu's and Lamarck's herbaria in Paris (P-J, P-Lam.) etc. and two micrifich readers have been procured.

A programme has been initiated for obtaining photo-negatives of specimens emanating from the Indian region and held in the 'Red Covers' in K, BM and E and considered as types or authentic specimens, as also of specimens of the respective families preserved in LINN and about 8000 negatives are already procured. The herbarium sheet photographed in K is given a BSI-negative no. such as BSI Neg. No. 1, 2, 3......5310 etc. and several rolls of such photo-negatives, are being received from Kew in CAL, where a full-plate print is made from each such negative. Such prints are mounted on normal herbarium-size boards, stitched at the corners, protected against wear and tear by a tissue paper mount and preserved in the 'Type' section, following the taxonomic sequence adopted in CAL. Seven sets of half-plate size photo-prints from each such negative are also being made and sent over to each of the Regional herbaria of BSI for study and reference. An *Index Card(s)* recording the appropriate name of the taxon, the negative number of the specimen with the label data photographed, a coloured dot to indicate the herbarium holding the specimen (viz. green for K, red for BM and yellow for LINN) accompanies each negative; specimens of Indian origin other than the 'type', if available in K or BM, are also cited in the Index Card. Such data, as these, would enable the taxonomists to look for duplicates of such collection-numbers, such as of *Gamble* 3496 in K, *Beddome* 285 in BM, *Clarke* 24196 in K etc. etc. in the Indian herbaria and, if available, they would supplement photoprints of 'types' for correct identifications of Indian plants.

Photographs of types of 352 species of African plants received from Missouri Botanic Garden, U.S.A., have also been incorporated.

ROLE OF CAL AS A SCIENTIFIC ORGANISATION AND AS A 'PUBLIC BUREAU'

At the time of transfer on 1.4.1957 from the West Bengal Government, the Systematic Wing of the Indian Botanic Garden, Howrah was manned by a Curator in Class II of West Bengal Service, one Lower Division Clerk. two Senior Herbarium Asstts., one Junior Herbarium Asstt., two Artists, one Printer and eleven Herb. Cleaners. At present the CNH has increased its sanctioned staff strength to 97 including 16 professional taxonomists (viz. Dy. Director 1, Keeper 1, Systematic Botanists 6, Botanists 7, Sr. Scientific Asstt. 1) and 39 Curatorial staff (viz. Curator 2, Scientific Asstts. 8, Herbarium Asstts. 7, Preservation Asstts. 4, Fieldmen 6, Mounters 5, Herbarium Attdts. 5, Farash 2).

But as a source for taxonomic teaching, research and service, every herbarium is regarded to-day both as a scientific organisation and a public bureau. The scientific and the curatorial staff of the CNH discharge different functions commensurate with the role of CAL as a national and international institution. They attend to various curatorial functions of the herbarium : (i) to maintain, fumigate, curate and develop the old and new aquisitions to the herbarium (ii) to act as liaison between the botanists and the national and the international herbaria in matters involving loan, receipt and exchange of specimens; (iii) to attend to the identifications of Indian plants and other numerous enquiries; (iv) to guide and explain to the visiting botanists and enlightened public the past history and the prestnt-day activities in the CAL.

It is relevant to mention here that during the five years period, 1972-76, CAL has sent specimens on loan and on exchange basis to Indian botanists (both departmental and non-departmental) and to botanists in U.S.A., Canada, U.K., the Netherlands, Denmark, West Germany and East Germany, Poland, U.S.S.R., Ghana, Australia and Japan on a number of occasions. Similarly, CAL has received 2564 specimens for incorporation from foreign herbaria in the countries mentioned above.

Representative Herbarium : For the benefit of students and teachers from Colleges and Universities, amateur botanists, individual research workers, horticulturists from government departments and other research institutes, CAL serves primarily a teaching function. A 'Representative' herbarium of Indian taxa with one or two specimens representing all species/varieties available in CAL has been constituted in replacement of several 'local herbaria' set up by William Griffith. To-date, more than 10,000 specimens have been segregated and classified after the pattern of the main herbarium, as an aid to quick identification of collections brought in or sent to CAL. Correct names of each and every taxon are being worked out in consultation with relevant literature and appropriate annotations made on species covers/index cards to serve as an updated checklist of

Indian flora. The Representative Herbarium organised on such a large scale in one of the largest and oldest herbaria of the world, is a unique feature of CAL.

OUTLINES FOR FUTURE

(i) *Fumigation chamber* : To provide the facilities of a fully equipped Fumigation Chamber to protect and insulate the herbarium specimens from fungal and insect attack, a 0.81 cu. m. = (30 cu. ft.) metallic chamber (120 cm × 90 cm × 75) with gas-leak-proof-built-in mechanism to use methyl bromide gas, either in 20 cc. ampules or by suction from a gas cylinder, is being installed.

To meet the long-term needs, however, air-conditioning of the herbarium and the 'Reference' library, is a must. If the proposal to air-condition at least parts of the CNH building is not immediately implemented on consideration of apparently huge initial cost involved, the valuable specimens and literature gathered over the last one hundred eightyfive years and housed therein, will undergo further deterioration necessitating repeated renovations of mounted specimens and change of genus and species covers, which entail wastage of manpower and recurring expenditure of several lakhs of rupees.

(ii) *Museum of (a) liquid preserved plant parts; (b) carpological collections* : For good taxonomic research we need (a) a museum of plants/plant parts preserved in liquid stored in jars and bottles, and (b) adequate carpological collections of bulky dried fruits/pods too unweildy for pressing and mounting (see Chatterjee 1948). Be it noted that the Kew Herbarium (K) holds in the 'Museum' about 35000 jars/bottles/tubes containing liquid-preserved rhizomes, corms, succulent fruits and delicate plant parts in a separate hall in the basement; its carpological collections run to thousands of dried unweildy fruits, pods etc. held in special type of wooden boxes built in close proximity to the respective family in the main herbarium itself.

We aim at making concerted efforts to remove these lacunae in the CAL by and by.

(iii) *Correct identification of Indian plants* : A task of more daunting nature before the CAL to-day is the correct identification of specimens held in its pigeon holes vis-a-vis the *International Code of Botanical Nomenclature*, 1978 abbreviated hereafter ICBN). This done, the road to publications of the Flora of India series would have been firmly laid. The national/regional *FLORAS* of India published upto 1935, preceded the formulation of the ICBN during 1930s and which have been evolving more adequately in the decades following. It is, therefore, essential and urgent that the reorganised CAL with as complete a replicate of the Indian flora as available to date and a repository of types and authentic specimens as discussed in preceding pages, should provide an ideal forum where correct identification and nomenclature of plants, have to be worked out. This poses a serious intellectual challenge which we have to face and find answers to.

(iv) In the life cycle of plant taxonomy, six phases of development are being recognised (see Shetler 1969) : (a) exploratory and descriptive; (b) floristic and phytogeographic; (c) systematics; (d) biosystematics; (e) ecosystematics; (f) computer taxonomy.

While the CNH in general and the BSI in particular are designed to take care of the five phases of this developmental cycle, the feasibility of introducing Electronic Data Processing and Information Retrieval (EDP-IR) systems, popularly known as computer methodology, into the taxonomic collections of BSI, is being examined. Government of India have approved the operation of two pilot projects : (i) the Botanical Type Specimens Register for India (see above) and (ii) on the endemics/rare plants of India to begin operation with the CNH as the nucleus. A suitable programme for computerisation of the endemics/rare taxa in Indian Flora is being formulated in consultation with the Regional Computer Centre, Jadavpur and the Computer Scientists in U.S.A. and U.K.

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